Risky Foods: To what extent do US consumers eat raw or undercooked animal foods?

Conclusion

Moderate, clear and consistent evidence shows that the consumption of raw or undercooked animal-source food products is relatively common in the US, especially for eggs and egg-containing products and ground beef products.

Grade: Moderate

Overall strength of the available supporting evidence: Strong; Moderate; Limited; Expert Opinion Only; Grade not assignable For additional information regarding how to interpret grades,click here.

Evidence Summary Overview

A total of eight studies were reviewed regarding the extent to which US consumers eat raw or undercooked animal foods. All of the studies (one meta-analysis, one systematic review and six cross-sectional studies) received neutral quality ratings.

In their direct observation study of US household meal preparers, Anderson et al (2004) found that 61% of those who prepared a chicken entrée undercooked the chicken. In this study, 46% of those who chose to prepare meatloaf undercooked the ground beef. In contrast, Dharod et al (2007b) documented that almost none (7%) of the Puerto Rican household meal preparers included in their study undercooked the chicken. Lopez Osorio et al (2008) found that US consumers were more likely than Argentinean and Spanish consumers to prefer beef steaks to be cooked rare. However, Trepka et al (2007) found in their study that only 3.5% of Women, Infants and Children (WIC) participants liked their meat cooked medium-rare or rare.

Studies reviewed have found that among diverse US study populations, raw or undercooked animal-derived products are widely consumed (Bryd-Bredbenner et al, 2008; Patil et al, 2005; Trepka et al, 2007). Bryd-Bredbenner et al (2008) reported that among a large sample of college students, a substantial number reported consuming a variety of risky foods, such as homemade cookie dough containing raw eggs (53%), fried eggs with runny or soft yolks (33%), sushi (29%), raw sprouts (29%), raw oysters, mussels or clams (11%) and rare hamburgers (7%). Trepka et al (2007) found that among female African-American WIC clients, 24.7% reported usually eating undercooked eggs, 51.6 percent of pregnant women reported “sometimes,” or “frequently,” eating hot dogs or deli meats since becoming pregnant without first reheating them, and 35.5% reported eating soft cheeses and blue-veined cheeses sometimes or more frequently since becoming pregnant. In addition, almost 12% reported consuming hamburgers with pink or red color inside, and only 62% reported always using boiling water before preparing infant formula.

The prevalent consumption of undercooked eggs detected in localized studies is confirmed by a systematic review (Redmond and Griffith, 2003) and the meta-analysis by Patil et al (2005). Based on US surveys conducted between 1977 and 2000, Redmond and Griffith (2003) report that the prevalence for this practice has ranged from 5% to 56%, with the most recent surveys suggesting that as many as half of the US population may consume undercooked or raw eggs.

Raw milk consumption has been associated with serious foodborne outbreaks in the US. Kaylegian et al (2008) examined raw milk consumption practices in a sample formed predominantly of dairy farmers from upstate New York. As many as 45.3% reported having consumed raw milk during the previous year. The main reasons for consuming raw milk were taste, convenience and cost. Concerns related to health hazards associated with raw milk consumption were expressed by 38.2% of the raw milk and 73.2% of the pasteurized milk consumers.

Evidence Summary Paragraphs

Anderson et al, 2004 (neutral quality), a cross-sectional study compared consumer food-handling behaviors with the Fight BAC! Consumer food-safety recommendations. Ninety-nine subjects (92 women and seven men) were randomly recruited by telephone, and videotaped in their home while preparing a meal. Videotapes were coded according to Fight BAC! recommendations, a food safety survey was administered and temperature data was collected. The authors found that many subjects undercooked the meat and poultry entrees and very few subjects used a food thermometer.

More specifically, 61% of those who prepared a chicken entrée undercooked the chicken, and 46% of those who chose to prepare meatloaf undercooked the ground beef. Overall, subjects did not follow the Fight BAC! recommendations for safe food handling.

Byrd-Bredbenner et al, 2008 (neutral quality), a cross-sectional survey assessed risky eating behaviors among 4,343 (female, 65%; male, 35%) young adults enrolled in 21 colleges and universities located in 17 US states (mean age 19.92±.67 years). Students across the US, enrolled in introductory courses, were invited to complete an online food safety survey between January and October, 2005. A calculated mean risky eating score of 5.1±3.6 indicated college students consume some risky foods (53% consumed raw homemade cookie dough; 33% consumed fried eggs with runny or soft yolks; 29% consumed sushi; 29% raw sprouts; 11% raw oysters, clams, or mussels; and 7% consumed hamburgers cooked rare). Men ate significantly more risky foods than women ($P<0.0001$), white participants engaged in significantly more risky eating behaviors than non-white participants ($P<0.001$). Students had strong feelings of food safety self-efficacy (4.1±0.6), were between the contemplation and preparation stage-of-change (2.7±1.2), believed food poisoning was somewhat of a threat (3.1±0.8) and had modest food safety knowledge.

Dharod et al, 2007b (neutral quality), a cross-sectional study, applied the Hazard Analysis Critical Control Points (HACCP) model at the household level to identify sanitation and food handling "Critical Control Points" for home prepared "Chicken and Salad" using direct observations and microbiological indicators. A sample of 60 Puerto Rican women recruited in inner city Hartford, Connecticut, were provided chicken breasts (CB), lettuce and tomatoes (LT) and spices to prepare a meal in their home kitchens; food and kitchen surface samples were collected during stages of food preparation and tested for total and coliform counts, and presence of pathogenic microorganisms; observed food handling behaviors were compared with microbial testing results. The authors observed that no participants used a thermometer to check whether the CB was adequately cooked [most determined doneness using cooking time and visual change in texture and color of meat and some (20%) tasted meat to determine doneness]. However, temperature measurements by research staff on meat showed that 93% of participants cooked the CB to an adequate temperature.

Kaylegian et al, 2008 (neutral quality), a cross-sectional survey determined raw milk consumption beliefs and practices among New York State dairy producers and farm workers. An eight-question survey was developed to collect information on demographics, previous household milk consumption practices, reasons for consuming or not consuming raw milk, whether raw milk was supplied to others in the community, demographics of community raw milk consumers and concerns about raw milk consumption practices. Data set was adjusted to only include dairy producers and farm workers so that 150 responses were analyzed from 336 mailed surveys. Regarding demographics of raw milk consumers, dairy producers represented the majority (89.7%) of raw milk drinkers while 10.3% were farm workers; 72% of raw milk consumers reported living on the farm; raw milk consumers were more likely ($P<0.05$) than pasteurized milk consumers to be associated with smaller farms; about 64% of the raw milk consumers were between 21 and 65 years of age and about 16% were less than 10 years old. In terms of their milk consumption habits, most (76.5%) raw milk drinkers indicated that they had been drinking unpasteurized milk for more than 21 years, 2.9% for six to 10 years and 5.9% for less than five years; the 68 raw milk consumers represented 45.3% of survey respondents and they obtained raw milk from the producers' bulk tank; 68 (45.3%) respondents reported consuming fresh raw milk from the farm; of 68 raw milk drinkers, 33 (50%) obtained milk solely from the farm and 33 (50%) also purchased some commercially processed (e.g., pasteurized) milk from a store. The average quantity of milk consumed per week did not differ much between raw and pasteurized milk households; consumption was 4.1 gallons per week and 3.5 gallons per week, respectively. The primary reasons that 66 raw milk drinkers gave for consuming raw milk included taste (56, or 84.8%), convenience (53, or 80.3%) and cost (38, or 57.6%). About 11% noted other reasons, such as "the family likes it better," "freshness," "they ran out of store milk," "they want the higher fat for butter making," or that it "was from grass-fed cows." 39 (29.8%) farms provided raw milk to the community. Concerns related to health hazards associated with raw milk consumption were expressed by 38.2% of the raw milk and 73.2% of the pasteurized milk consumers.

López Osorio et al, 2008 (neutral quality), a cross-sectional study designed to predict the optimum cooking temperatures of beef based on acceptance or rejection using survival analysis statistics. Data from 306 subjects from Argentina, Spain and the US were segmented by age groups (young and middle-aged adults) and stated preference for degree of doneness (rare, medium and well-done). Subjects were asked to look at pictures from the American Meat Science Association (AMSA) Color Guide and decide if these were undercooked, okay or overcooked. Survival analysis statistics were applied to the data to predict optimum internal cooking temperatures. The 95% CI were: 75±6.2°C, 78±4.3°C and 82±2.6°C, for consumers stating a preference for rare, medium and well-done beef, respectively. The 55°C picture of the AMSA Color Guide was rejected as meat undercooked by almost all consumers, including those who stated they preferred ‘‘rare" beef. At the other extreme, the 82°C picture was rejected as meat undercooked by 29% of those consumers who stated they preferred their beef ‘‘well-done," but not all consumers

found the 82°C picture to be overcooked; 65% of those who stated they preferred ‘‘rare” beef found this picture to be overcooked. The middle-aged consumers tended to have lower rejection probability (16%) than the younger consumers (23%) due to the beef being overcooked. US consumers were more likely than Argentinean and Spanish consumers to prefer beef steaks to be cooked rare. Country of residence and age group had little influence on optimum temperatures.

Patil et al, 2005 (neutral quality), a meta-analysis of 20 studies evaluated United States consumers' consumption of raw or undercooked foods, knowledge of proper food safety practices and reported behaviors, based on demographic differences (gender, ethnicity, age, education, geographic region and metropolitan vs. non-metropolitan area). Findings from the studies were combined using meta-analysis methods to estimate percentages of consumers engaging in risky behaviors, such as consumption of raw food, poor hygiene and cross-contamination, separated by various demographic categories. Consumer knowledge of safe handling practices did not correspond with reported use of the practices, suggesting that knowledge is a poor indicator of behavior. Compared with women, men reported greater consumption of raw or undercooked foods (26.7%); mid-age adults consumed more raw food (except milk, 24.7%) than did young adults and seniors; high-income individuals reported greater consumption of raw foods (29%); the highest raw ground beef and egg consumption (29%) were found in the US Mountain region; more people consumed raw or undercooked eggs (47%) than consumed raw or undercooked ground beef (21%), shellfish (12%) and raw milk (2.1%); consumption of raw or undercooked food varied by gender, ethnicity, age, income, education level and region.

Redmond and Griffith, 2003 (neutral quality), a systematic review reviewed 88 food safety studies regarding consumer food handling in the home, published over a 26-year period. The majority of all the studies conducted (55 studies) were between 1995 and 1999. After 1999, in only two years, an additional 26 studies were completed, reflecting an increasing trend in foodborne illness incidence. Seven of 15 observational studies involved direct observations, out of which three (43%) were carried out in the US. Based on US consumer food safety surveys undertaken from 1977 to 2000, large proportions of consumers reported eating raw foods of animal origin. Since 1977, the prevalence of the consumption of undercooked hamburgers has ranged from 4% to 30% of sampled population; since 1997, some surveys have indicated that less than 5% of consumers report preference for and the consumption of medium rare and rare hamburgers. Since 1994, the prevalence of consumption of undercooked or raw eggs has ranged from 5% to 56%; the levels of consumption of such eggs appear to have been consistent from the mid-1990s to present such that up to 50% of consumers may still consume raw and undercooked eggs. One US study indicated that susceptible populations with high risk for foodborne illness continue to consume inadequately cooked runny eggs and pink beef burgers. Authors note that social desirability bias may have had the effect of reducing the prevalence of the consumption of unsafe foods, so that the actual prevalence of these practices may be higher than reported.

Trepka et al, 2007 (neutral quality), a cross-sectional study assessed baseline food safety practices among 299 adult female clients served by an inner city MiamiWIC program. A 23-item self-administered questionnaire addressed food safety practices related to cleanliness, separation or avoidance of cross-contamination, proper cooking and chilling methods and avoidance of unsafe foods during pregnancy. The proportion of respondents reporting usually eating undercooked eggs was 24.7%, while 28.4% reported eating undercooked eggs at least some of the time, which was lower than reported in the Centers for Disease Control and Prevention’s (CDC) 1996 Behavioral Risk Factor Surveillance Survey (50%). Over one-half (51.6%) of the 62 pregnant women participants reported eating hot dogs or deli meats without first reheating "sometimes" or more frequently since becoming pregnant, and 35.5% reported eating soft cheeses and blue-veined cheeses "sometimes" or more frequently since becoming pregnant; both practices increasing risk of acquiring listeriosis. A high prevalence of pregnant participants ate foods that put them at risk of listeriosis at least some of the time (over one-half for hot dogs, luncheon meats or deli meats that were not reheated to steaming hot and one-third for soft cheeses, although it was unclear which food item the participants were referring to when they reported eating hot dogs, luncheon meat or deli meats). Only 3.5% of participants reported usually eating pink or under-cooked meat.

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Author, Year, Study Design, Class, Rating	Population/Sample Description	Study Design/I & D Variables/Intervention	Results/Behavioral Outcomes/Significance	Limitations

Anderson J, Shuster T et al, 2004 Study Design: Cross-sectional study Class: D Rating: 	Initial N=92 women, seven men. Final N=99; predominately white (% not reported); middle-class residents from a county that consists of a small urban area surrounded by rural communities. Location: United States.	**Design:** Observational study (participants were videotaped while preparing a single entree and salad) and self-report food handling survey (included questions about the observed food preparation session, perceptions about food safety and foodborne illness risk, final cooking temperatures, handwashing, surface cleaning and food storage). Temperature of cooked meat entree data was collected. **Dependent variables:** Observed food safety behaviors of subjects (handwashing; surface cleaning; cross-contamination; determining doneness of the entree; food storage practices; vegetable cleaning). **Independent variables:** Fight BAC! consumer food safety recommendations related to: Clean (handwashing, surface cleaning, vegetable cleaning) Separate (cross-contamination) Cook (determining doneness of entree, food thermometer use, internal cooking temperatures, oven temperatures) Chill (chilling, thawing, refrigerator	Many participants undercooked meat and poultry entrees. Very few subjects used a food thermometer (nearly one-half of subjects reported not knowing the recommended final internal cooking temperature for chicken and ground beef). Chicken breast was most frequently undercooked, with 20 of 33 (61%) of subjects failing to meet the Fight BAC! temperature standards. Final temperatures of meatloaf ranged from 129°F to 197°F; 17 of 36 (46%) subjects undercooked the meatloaf entree according to Fight BAC! recommendations.	**Authors indicated:** Participants' food safety knowledge and attitude data from the food safety survey collected during the study did not correspond with their observed behaviors. Survey data showed participants know more about food safety than their behavior demonstrated. Participants were recruited under the pretense of market research for food preparation practices in an effort to eliminate bias for food safety research.

		temperatures).		
Byrd-Bredbenner et al, 2008 Study Design: Cross-sectional study Class: D Rating:	N=4,343 college students (females 65%, males 35%) from 21 colleges or universities located in 17 US states. Mean age: 19.92±.67 years. 84% prepared one meal a day.	**Online survey assessed:** Consumption of risky foods and preparation behaviors (six safe foods, 20 risky foods, seven risky behaviors; scale one to five) Food safety self-efficacy (24 items, scale one to five) Stage-of-change (scale one to five) Knowledge (zero to 89) Perceived food poisoning a threat (scale one to five) Demographics Type food safety information exposure Number of meals prepared weekly (zero to 10 or >10) Prior food poisoning illness.	Self-reported mean risky eating behaviors score was 5.1±.3.1 (zero to 27 scale, ↑ risky behavior yields ↑ score). Percent consumed: • 53% raw homemade cookie dough • 33% fried eggs with runny or soft yolks • 29% sushi • 29% raw sprouts • 11% raw oysters, clams or mussels • 7% hamburgers cooked rare. Men ate significantly ↑ risky foods than women (P<0.0001) and white participants engaged in significantly ↑ risky eating behaviors than non-white participants (P<0.001).	Not randomized or nationally representative sample.
Dharod et al, 2007b Study Design: Cross-sectional study Class: D Rating:	N=60 Puerto Rican women, main meal preparers of the household recruited from inner city Hartford, Connecticut. Mean age: 40 years. More than half (N=36) spoke only Spanish at home. Half (N=33) had < high school education. Half (N=33) had a monthly income of ≤$1,000. Most (N=51) were	**Design:** Subjects were provided chicken breasts, lettuce, tomatoes and spices to prepare a meal in their home kitchens. Food and kitchen surface samples were collected during stages of food preparation and tested for total and coliform counts and presence of Listeria, Campylobacter, Salmonella genus and S. aureus. Observed food handling behaviors were compared with microbial testing results and were	**Risky Foods:** The authors observed that no participants used a thermometer to check whether the CB was adequately cooked (most determined doneness using cooking time and visual Δ in texture and color of meat and some (20%) tasted meat to determine doneness). However, temperature measurements by research staff on meat showed that 93% of participants cooked the CB to an adequate temperature.	None.

	unemployed.	used to identify critical control points during the meal preparation.		
Kaylegian KE, Moag R et al, 2008 Study Design: Cross-sectional survey Class: D Rating:	Initial N=448 surveys mailed out. Final N=196 responses. Data set adjusted to only include NY State dairy producers and farm workers (336 mailed surveys; 150 responses). Location: United States.	An eight-question survey was developed to assess current beliefs and practices regarding raw milk consumption. Questions were developed to collect information on demographics, household milk consumption practices in previous year, reasons for consuming or not consuming raw milk, whether dairy producers supplied raw milk to others in the community beyond their own household members, demographics of community raw milk consumers, concerns about raw milk consumption and calf feeding practices. Questions were tested by dairy producers to ensure that language was appropriate and that all of the desired information would be captured. Survey was sent in two mailings and a requested timeframe of three weeks was given for its return.	**Demographics of raw milk consumers:** Dairy producers represented the majority (89.7%) of raw milk drinkers, while 10.3% were farm workers. 72% of raw milk consumers reported living on the farm. Raw milk consumers were more likely (P<0.05) than pasteurized milk consumers to be associated with smaller farms. ~64% of the raw milk consumers were between 21 and 65 years of age and ~16% were <10 years old. **Milk consumption habits:** Most (76.5%) raw milk drinkers indicated that they had been drinking unpasteurized milk for >21 years, 2.9% for six to 10 years and 5.9% for The 68 raw milk consumers represented 45.3% of survey respondents and they obtained raw milk from the producer's bulk tank. 68 (45.3%) respondents reported consuming fresh raw milk from the farm. Of 68 raw milk drinkers, 33 (50%) obtained milk solely from the farm, whereas 33 (50%) also purchased some commercially processed	The raw milk consumption practices of dairy farm producers and farmworkers may not represent the beliefs and practices about raw milk of typical consumers. Findings may not be generalizable to other States outside of NY. No information on history or experience of participants with raw milk-related illnesses.

			(e.g., pasteurized) milk from a store. The average quantity of milk consumed per week did not differ between raw and pasteurized milk households. Consumption was 4.1gal per week and 3.5gal per week, respectively. **Reasons for consuming raw milk:** Of the 66 raw milk drinkers who reported reasons for consuming raw milk, the primary reasons given for consuming raw milk were taste (56, or 84.8%), convenience (53, or 80.3%) and cost (38, or 57.6%). About 11% noted other reasons, such as "the family likes it better," "freshness," "they ran out of store milk," "they want the higher fat for butter making," or that it "was from grass-fed cows." **Supplying raw milk to community:** 39 (29.8%) farms provided raw milk to the community. Of the 39 farms, 27 (69.2%) supplied raw milk to farm workers, 14 (35.9%) supplied raw milk to extended family members, 11 (28.2%) supplied milk to neighbors and three (7.7%) supplied raw milk to tourists or local consumers with a preference for raw milk.	

López Osornio M, Hough G et al, 2008 Study Design: Cross-sectional study Class: D Rating: 	N=306 subjects who consumed cooked beef at least once a week in Argentina, Spain and the US. Data were classified according to age (range): 1) Young (21 to 30 years) 2) Middle-aged (40 to 60 years).	Using the US Beef Steak Color Guide (American Meat Science Association), consumers had to indicate if they considered the meat in a picture: undercooked, okay or overcooked. Subjects were also asked how they normally consumed beef: "Rare," "medium," "well done" or "other." The explanatory variable was internal cooking temperature (ICT). For each value of ICT-t, there are two rejection functions: The probability of a consumer rejecting beef because is undercooked or overcooked (with ICT=t).	The 95% CI were 75±6.2°C, 78±4.3°C and 82±2.6°C, for consumers stating a preference for rare, medium and well-done beef, respectively. The 55°C picture of the AMSA Color Guide was rejected as meat undercooked by almost all consumers, including those who stated they preferred "rare" beef. At the other extreme, the 82°C picture was rejected as meat undercooked by 29% of those consumers who stated they preferred their beef "well-done," but not all consumers found the 82°C picture to be overcooked; 65% of those who stated they preferred "rare" beef found this picture to be overcooked. The middle-aged consumers tended to have lower rejection probability (16%) than the younger consumers (23%) due to the beef being overcooked. US consumers were more likely than Argentinean and Spanish consumers to prefer beef steaks to be cooked rare. Country of residence and age group had little influence on optimum temperatures.	The study examines consumer preferences for meat cooked to different temperatures, or appearance, not actual food safety behaviors. It is unclear how participants were recruited and what their characteristics were, other than the fact that they ate beef more than once per week.
Patil S, Cates S et al, 2005 Study Design: Meta-Analysis Class: M	20 studies of US consumers.	Evaluation of consumers' consumption of raw or undercooked foods, knowledge of proper food safety practices and reported behaviors, based on demographic differences (gender,	Consumer knowledge of safe handling practices did not correspond with reported use of the practices, suggesting that knowledge is a poor indicator of behavior.	Search terms and databases not described. Study quality and validity not assessed.

Rating:		ethnicity, age, education, geographic region and metropolitan vs. non-metropolitan area). **Dependent variables:** These behavioral measures were included in the meta-analysis: Consumption of raw or undercooked ground beef, eggs, shellfish, and milk Knowledge of good hygiene practices Practices to prevent cross-contamination Proper defrosting methods Apparently safe food sources Proper cooking and heating practices Handling practices for hygiene Prevention of cross-contamination Food holding Cold storage Avoidance of unsafe foods Cooking and heating. **Independent variables:** These demographic characteristics were included in the meta-analysis: gender, ethnicity, age, education, geographic region, metropolitan vs. non-metropolitan.	Compared with women, men reported ↑ consumption of raw or undercooked foods (26.7%). Mid-age adults consumed ↑ raw food (except milk, 24.7%) than did young adults and seniors. High-income individuals reported ↑ consumption of raw foods (29%). The highest raw ground beef and egg consumption (29%) were found in the US Mountain region. More people consumed raw or undercooked eggs (47%) than consumed raw or undercooked ground beef (21%), shellfish (12%) and raw milk (2.1%). Consumption of raw or undercooked food varied by gender, ethnicity, age, income, education level and region.	

Redmond E and Griffith C, 2003 Study Design: Systematic Review Class: M Rating:	88 food safety studies published over a 26-year period. The majority of consumer food safety studies in the last decade have been conducted in the United Kingdom and Northern Ireland (48%) and in the US (42%).	**Design:** Food safety findings relating specifically to food preparation in the domestic kitchen. Information was provided regarding similarities and disparities between knowledge, attitudes, intentions, self-reported practices and actual behaviors from studies on domestic food preparation. Studies were evaluated in terms of the research method implemented for data collection, the study size, the country of origin and the year of study completion. **Dependent variables:** Food safety findings relating specifically to food preparation in the domestic kitchen. **Independent variables:** Social cognitive components (consumers' knowledge, attitudes, intentions) Observed hygiene behaviors Self-reported practices.	Based on US consumer food safety surveys undertaken from 1977 to 2000, large proportions of consumers reported eating raw foods of animal origin. Since 1977, the prevalence of the consumption of undercooked hamburgers has ranged from 4% to 30% of sampled population. Since 1997, some surveys have indicated that <5% of consumers report preference for and the consumption of medium rare and rare hamburgers. Since 1994, the prevalence of consumption of undercooked or raw eggs has ranged from 5% to 56%. The levels of consumption of such eggs appear to have been consistent from the mid-1990s to present, such that up to 50% of consumers may still consume raw and undercooked eggs. One US study indicated that susceptible populations with high risk for foodborne illness continue to consume inadequately cooked runny eggs and pink beef burgers.	Search terms and databases not described. Study quality and validity were not assessed in this review. Authors note that social desirability bias may have had the effect of ↓ the prevalence of the consumption of unsafe foods.
Trepka M, Newman F et al, 2007 Study Design: Cross-sectional study Class: D Rating:	Initial N=342. Final N=299 female WIC clients from inner-city Miami. 64% non-Hispanic, non-Haitian black; 27.1% Hispanic. 21.5% were pregnant.	**Design:** 23-item self-administered questionnaire. Captured five constructs of food safety behavior, with the first four from the Partnership for Food Safety Education's Fight BAC! campaign.	The proportion of respondents reporting usually eating undercooked eggs was 24.7%, while 28.4% reported eating undercooked eggs at least some of the time, which was ↓ than reported in the CDC's 1996 Behavioral Risk Factor Surveillance Survey (50%).	**Authors noted these limitations:** Although refusal rates were low, those who refused may have been unconcerned with food safety and had worse

	89.4% had graduated from high school. 87.4% response rate.	**Dependent variables:** Four construct scores (clean, separate, cook, chill). Score concerning avoidance of unsafe foods during pregnancy. Variables measured using 23-item self-administered survey. **Independent variables:** Nine participant characteristics (age; education; race or authenticity; country of birth; employment status; pregnancy status; number of children; diarrhea among household members in last month; household member at risk for food-borne illnesses).	51.6% of the 62 pregnant women participants reported eating hot dogs or deli meats without first reheating "sometimes" or more frequently since becoming pregnant and 35.5% reported eating soft cheeses and blue-veined cheeses "sometimes" or more frequently since becoming pregnant (both practices ↑ risk of acquiring listeriosis). A ↑ prevalence of pregnant participants ate foods that put them at risk of listeriosis at least some of the time (over one-half for hot dogs, luncheon meats or deli meats that were not reheated to steaming hot and one-third for soft cheeses, although it was unclear which food item the participants were referring to when they reported eating hot dogs, luncheon meat or deli meats). Only 3.5% of participants reported usually eating pink or undercooked meat.	had worse practices than those who participated. Inconsistencies in responses between two questions about cooking eggs and between the two questions about how promptly foods were chilled (suggesting that almost one third of the group was leaving out food for an unsafe period). Participants were not necessarily representative of other WIC clinics, Florida or the US. Study assessed only self-reported practices, not actual practices and did not assess knowledge or attitudes; thus, it was not possible to determine underlying reasons for specific unsafe practices.

Research Design and Implementation Rating Summary
For a summary of the Research Design and Implementation Rating results, click here.

Worksheets

Anderson JB, Shuster TA, Hansen KE, Levy AS, Volk A. A camera's view of consumer food-handling behaviors. *J Am Diet Assoc.* 2004; 104: 186-191.

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